

US EPA ARCHIVE DOCUMENT

112701

SHAUGHNESSEY NO.

6
REVIEW NO.EEB BRANCH REVIEW

DATE: IN 10-6-80 OUT 11-17-80

FILE OR REG. NO. 10182-EUP-ER

PETITION OR EXP. PERMIT NO.

DATE DIV. RECEIVED 10-6-80

DATE OF SUBMISSION 9-29-80

DATE SUBMISSION ACCEPTED 9-29-80

TYPE PRODUCT(S): I, D, H, F, N, (R), S Rodenticide

DATA ACCESSION NO(S). N/A

PRODUCT MANAGER NO. 16 (Miller/Mautz)

PRODUCT NAME(S) Volak

COMPANY NAME ICI

SUBMISSION PURPOSE Experimental use permit to collect efficacy and
secondary hazard information.

SHAUGHNESSEY NO.

CHEMICAL, & FORMULATION

% A.I.

112701

Brodifacoum - Black pellets

10 ppm

100.0 Pesticide Use

Volak pellets are to be used as a broadcast rodenticide. The area for this study is a dormant apple orchard.

100.1/2 Application Methods/Directons/Rates

Volak pellets will be broadcast over the 175 acre test area at a rate of 20 lbs. product per acre. Pellet concentration has been reduced from 50 ppm to 10 ppm for this applicaton. The total amount of active ingredient applied per acre is 0.0002 lbs. a.i./acre. Application will be made when the orchard becomes dormant (not actively producing). Application is currently scheduled for late November 1980.

100.3 Precautionary Labeling

The following label precautions are proposed for the label:

This product may be toxic to fish and wildlife. Keep out of lakes, ponds or streams. Do not contaminate water by cleaning of equiptment or disposal of wastes. Baits must be placed in areas not accessible to children, pets, wildlife and domestic animals. Do not use hay cut from treated areas for feed or bedding.

NOTE: The label should be changed to reflect a more reasonable policy towards exposure to wildlife. For this permit, wildlife does not need to appear on the label. It is not realistic to broadcast the pellets and not be a hazard to wildlife.

100.4 Proposed Program

100.4.1 Objectives:

The specified goal of this study is:

To obtain a sound data base regarding non-target hazard for broadcast applications of 10 ppm BFC pellets (Volak) in orchards for meadow vole control thus allowing EPA to make an objective decision regarding registration of the material for this use.

General objective 1 is:

To establish secondary non-target hazard of a broadcast application of 10 ppm BFC pellets to birds of prey (specifically, screech owls Otis asio, with a lesser emphasis being placed on barred and great horned owls; only casual effort will be directed toward diurnal birds of prey).

General objective 2 is:

To establish existing levels of meadow vole population prior to treatment and then 4 weeks post-treatment.

General objective 3 is:

To establish primary hazard of broadcast application to song birds and game animals (cottontail rabbit and bobwhite quail).

100.4.2 Duration/Date/Amount Shipped

Four thousand (4,000) pounds of product are to be used in the one year study. The proposed study dates run from Nov. 1980 to Nov. 1981. The majority of the product will be used during a one-time application in November 1980. Additional spot treatments may be necessary later to reduce damage from small localized populations if they exist.

100.4.3 Application Procedure

The pesticide will be applied via tractor mounted broadcast spreader calibrated to deliver from 18 - 22 lbs. (average 20 lbs.) of product per acre. The application will be made after the pre-treatment vole census is taken and the owls have been caught and radios have been placed on the birds.

100.4.4 Target pests

The identified target pests are "orchard voles" of the genus Microtus.

100.4.5 Geographic Site Features

The study will be conducted in the Harmony Hollow Orchard located in Front Royal, Virginia.

While testing the effects of Volak last year during a similar EUP, several (4-5) screech owls were lured to the area. Other raptors (hawks) have been seen in the area. The investigators feel confident that several (4-8) raptors can be radio tagged and studied.

100.4.6 Test Program Description/Features

To accomplish ^egeneral objective 1 (to establish secondary non-target hazard to raptors) the following specific objectives have been suggested. (Objectives have been abbreviated.)

- a. Capture and fit 4-10 owls with radio transmitters one week prior to BFC treatment.
- b. Collect meadow voles 1,3,7 and 14 days post-treatment and sacrifice them to determine BFC residues in muscles and organs.
- c. Collect owl pellets post-treatment from roosting sites to determine BFC presence/concentrations.
- d. Perform ground searches in the orchard 1 and 2 weeks post-treatment.
- e. Perform autopsies on all owls fitted with transmitters or any birds of prey found dead in the treatment area.

- f. Census treated and control orchards pre- and post-treatment
for screech owl numbers using responses to tape recorded calls.
- g. Capture hawks in the orchard to:
 - band and color mark
 - observe use of the orchard
 - solicit observations of marked birds from bird watchers.
- h. Collection of study owls (owls fitted with transmitters)
for BFC residue determination 4 weeks post-treatment.

General objective 2 (census the meadow vole population pre-treatment and 4 weeks post-treatment). Population estimates will be conducted via capture-recapture methods (Schnabel estimator).

General objective 3 (establish primary hazard to songbirds and game animals). This will be accomplished by:

- a. transect census of songbirds pre and post-treatment in the test and control areas.
- b. ground searches for carcasses and analysis for BFC residues.

101.0 Physical and Chemical Properties

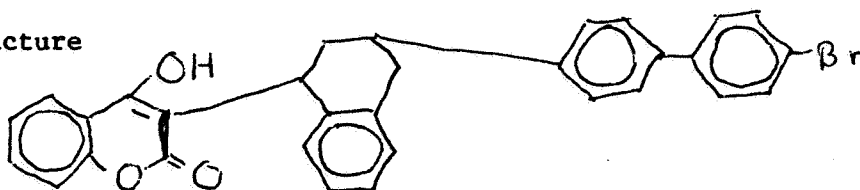
101.1 Chemical Name

3-[3-(4 'brono[1,1 '-biphenyl]4-yl)-1,2,3,4-tetrahydro-1-naphalenyl]
4-hydroxy-2H-1 benzopyran-2-one

101.2 Common Name

Brodifacoum

101.3 Chemical Structure



Exists as both the cis and trans isomers

101.4 Molecular Weight

523.4

101.5 Physical State

Off-white or buff colored, odorless solid.

101.6 Solubility

<u>Solvent</u>	<u>g/100 ml at 20°C</u>
water	< 0.01
acetone	0.06
ethanol	0.01
chloroform	3.0

102.0 Behavior in the Environment

The following fate data represents the information in the EFB file for Brodifacoum as of 11-12-80. Copies of the reviews are included in the EEB file.

102.1 Soil

Degradation of the pesticide in soil under lab conditions. Results:

1. Brodifacoum isomers are stable to hydrolysis at pH 4,7, and 9 at temperatures of 20° and 45° C, and at concentrations of 1 and 10 ppm.
2. Under aerobic and flooded conditions, BFC degrades in ^acoarse sandy loam, clay loam and coarse sand soils with the trans-isomer degrading more rapidly than cis.

Brodifacoum dissipation rate was highest in alkaline soils when it was applied at the rate of 1.75 lbs/soil.

102.2 Water

Hydrolysis in dark aqueous systems. Results:

1. The concentration of radioactivity in the pH 7 and 9 solutions at 1 and 10 ppm and at 20° and 25° C remained unchanged between

3 and 30 days.

2. Brodifacoum is stable to hydrolysis under conditions used with no significant formation of 4-hydrocoumarin found.

3. The ratio of isomers remain essentially unchanged through out the study.

103.0 Toxicological Properties

The following is a summary of pertinent data from other reviews.

103.1 Acute Toxicity

103.1.1 Mammal (data from the 11-16-79 review by D. Balcomb)

male rat acute oral LD50 (tech)	0.27 mg/kg
female rat acute oral LD50 (tech)	0.50 mg/kg
mouse acute oral LD50 (tech)	0.4 mg/kg
rabbit acute oral LD50 (tech)	0.29 mg/kg
cat acute oral LD50 (tech)	25.0 mg/kg
guinea pig acute oral LD50 (tech)	2.78 mg/kg
dog acute oral LD50 (tech)	0.25 - 1 mg/kg
sheep acute oral LD50 (tech)	25.0 mg/kg

103.1.2 Bird

Mallard acute oral LD50 (?% a.i.)	2.0 mg/kg (supp)
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103.1.3 Fish

rainbow trout 96-hr LC50 (92.5%)	0.039 ppm* (core)
rainbow trout 96-hr LC50 (0.25%)	10.6 ppm* (core)**
bluegill sunfish 96-hr LC50 (0.25%)	7.5 ppm* (core)**

* Measured concentrations

** Core for the formulation only

103.1.4 Invertebrates

<u>Daphnia magna</u> 48 hr LC50 (93.3%)	0.89 mg/l (core)
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103.3 Subacute Toxicity

Bobwhite quail 40-day dietary LC50 *	0.8 ppm (core)
Mallard duck 40-day dietary LC50 *	2.7 ppm (core)

* 40 day LC50= 5 days of treated diet and 35 days observation

103.5.2 Secondary Toxicity

See the 4-26-79 review by L. Turner for details of secondary toxicity tests on beagle dog, fox and barn owl. In general, the studies with the beagle and owls showed secondary toxicity problems. The fox study was inconclusive due to lack of data.

104.0 Hazard Assessment

An adequate general assessment of hazard appears in the 9-5-78 review by L. Turner. The following are appropriate sections of his review:

Since application is to be made during the dormant season in relatively cooler areas of the U.S., the avian exposure would be limited to non-migratory birds plus a few migratory birds that may winter in such areas. These would include a number of hawks and owls, a few upland game birds such as quail, pheasants, and grouse, and a few passerine birds such as chickadees, robins, thrashes, titmice, and starlings. Some of these birds have bills too small to likely be affected and others have food habits that would not include pellets. In addition, there is a strong possibility of secondary toxicity to raptors. It should be noted that Brodifacoum is one of the most toxic of the anticoagulant rodenticides and unlike many others has a demonstrated toxicity to birds as well as mammals.

A number of mammals, besides the target voles, may also be exposed from orchard applications. These would include squirrels, chipmunks, lagomorphs, cricetine rodents, deer, raccoon, and predators such as canids and mustelids. Domestic dogs would seem quite likely to be exposed, as might cats.

Other mammalian predators that may be exposed, in addition to the relatively insensitive felids, include weasels, skunks and possibly badgers, mink and all members of the family Mustelidae. We have no acute toxicity values for a mustelid, but if they are sensitive, secondary toxicity studies should also be conducted with a representative of this family. (NOTE, a mink LD50 study has been done. The results were around 10 mg/kg. This study is yet to be submitted to the Agency.)

104.1.2 Endangered Species Considerations

Species known to frequent the state of Virginia and have a potential

for hazard are the bald eagle, American and Arctic peregrin falcon. The hazard to these species is questionable. The ability of pesticide is not in doubt, what is unlikely is that the birds will be present in the study area. The falcon's are migratory birds which spend the majority of their time close to the coast (personal communication with Jay Shepard, OES, 8-235-1975). The possibilities of falcons or eagles being in the Front Royal area are remote.

107.0 Conclusions

The Ecological Effects Branch has several concerns about the proposed study being able to fulfill the expressed goal; however, we do not have an objection to issuance of the experimental use permit.

The possibility of endangered birds (namely the bald eagle, the Arctic and American peregrin falcon) migrating through the study area is remote yet possible. To guard against the possibility of a secondary hazard to these birds, it is requested that the three species be included in the bird survey (general objective 3a) which is scheduled prior to application. If they are sighted, treatment should be delayed until the bird or birds have migrated from the area.

The concerns raised during the 10-19-80 meeting with Mr. Wagner regarding the ability of this study to achieve the stated goals are still relevant. It is unlikely that this study will provide all the information this Branch needs to make a secondary hazard determination. Aspects of the study this Branch believes to be


inadequate include:

- The sample size of radio tagged birds and mammals,
- the size of the study area,
- the degree of the monitoring effort expended on the radioed animals,
- diet analysis of the studied birds and mammals.

This Branch welcomes inquiries as to the suitability of proposed protocols and would welcome the opportunity to discuss a proposed study plans to ensure the Branch's information requirements are satisfied.


J. Tice
Fish and Wildlife Biologist
Ecological Effects Branch

11-17-80


H. Craven
Section Head (Section 4)
Ecological Effects Branch

11-17-80


C. Bushong
Branch Chief
Ecological Effects Branch

11/17/80

RECORD OF TELEPHONE CALL OR VISITOR

DATE

14

INCOMING CALL ☐

OUTGOING CALL ☐

VISITOR ☒

10-19-80

NAME OF PERSON

Jim Wagner

RE 112701 VOLAK.

NAME & ADDRESS OF COMPANY

ICI Americas Inc.

COMPANY TEL. NO. (Include Area Code)

(302) 575-2596

REGISTRATION NO. OR FILE SYMBOL

Wilmington, DE 19897

DATE OF LATEST SUBMISSION

BRIEF SUMMARY OF CONVERSATION

Present were Jim Wagner (ICI), Dan Peacock (Reg. Div.) and representing EEB were Ray Matheny, John Tice, Russ Farringer, Ed Fite, John Leitzke and Carol Natella.

Mr. Wagner briefly went over the present status of Volak's (Brodifacoum - 112701) toxicity studies. A mink LD50 had recently been completed (approx. LD50 = 10 ppm) and the Barn Owl secondary toxicity study, conducted by USDI, is near completion with the written results expected in approximately 1 year.

The expressed purpose of the meeting was to talk about the obstacles or problems anticipated in registering Volak for an orchard use.

ACTION TAKEN

EEB's response was primarily aimed at problems with the protocol used in their recent EUP (10182-EUP-ER). Many procedural inadequacies and shortcomings were identified. The consensus of opinion was that further field studies evaluating the primary and secondary hazard to mammals and birds will be necessary.

RECORDED BY (Name)

J. Tice

REFERRED TO (Name)

11

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: 4/8/80

SUBJECT: ICI Americas Inc. Proposed Protocol to Evaluate the Secondary Hazards to Barn Owls resulting from the outdoor use of TALON™

FROM: Wildlife Biologist
Ecological Effects/HEDTO: Mr. William H. Miller
Product Manager, Team 16
and
Mr. Dan Peacock, Biologist

THRU: Raymond Matheny, Section Head, Sec. 1 EEB/HED

THRU: Clayton Bushong, Branch Chief EEB/HED

Ecological Effects Branch (EEB) has the following comments on the proposed protocol:

- (1) The exact location of the study area should be supplied with the EUP. The study area should be described as within a section of a county within the particular state. Also, a map showing site locations and distances between sites would be of interest.
- (2) Based on the telephone call with Mr. Paul Hegdall (4/7/80, USFWS-Denver, Colorado) 20 owls will be captured and radio tagged. Of these, fifteen owls will be in treated areas and five owls will be used as controls. All birds will be free ranging.

Some preliminary chi-square data analysis on hypothetical data using 33% mortality of treated birds and zero mortality of control birds gave a probability of 0.1937. This value ($\chi^2_{0.1937}$) would appear insignificant as far as data evaluation, however would relate to a 33% mortality in the field. Our data analysis of a 20-owl sample begins to become significant when 8 out of 15 treated birds die and no control mortality is seen. that is to say when 53.3% of the treated birds die we would arrive at a significant chi-square value ($\chi^2_{0.0511}$). Thus, due to a small sample size, chi-square analysis or any other statistical procedure, will be relatively insensitive to levels of mortality (<50%) that are biologically meaningful.

(3) Label Directions

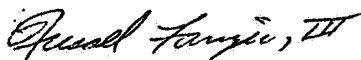
Under Selection of treatment areas, the first sentence "after removing as much food, water and harborage as possible, determine areas where rats or mice will most likely find and consume the bait," raises some possible questions. First, the disruption of the food, water-shelter complex has been shown to cause emigration and movement modification of rats (P.C. Dr. William B. Jackson, Environmental Studies Center, Bowling Green State University, Bowling Green, Ohio, 4/8/80. Second,


the average person using baits will seldom spend extensive amounts of time removing food, water and harborage. EEB feels that where feasible only removal of food sources should be attempted. This should cause the rats to feed more extensively at the bait stations, and reduce the possibility of emigration due to disturbances.

(4) Bait Boxes

The protocol states that "four bait boxes will be used at each site." EEB questions why this number of boxes was chosen. Will the structures be sufficiently small enough that four bait boxes will lie within the foraging ranges of all rats within a structure? Are boxes going to be sufficiently large enough to hold up to the maximum of 16 ounces of bait? Will the structure site, bait box placement and owl roost location be reported?

These are the main comments and questions that the Ecological Effects Branch has at this time.


Russel Farringer, III
Wildlife Biologist


Richard Balcomb
Wildlife Biologist

TALONTM

RODENTICIDE PELLETS For Effective Indoor Control of Commensal Mice and Rats

ACCEPTED

NOV 2 1979

Under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, for the pesticide registered under E. A. Reg. No. 10182-26

DIRECTIONS FOR USE

GENERAL CLASSIFICATION

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

USE RESTRICTIONS: For control of Norway rats, Roof rats and House mice in homes and industrial buildings. TALON may also be used inside transport vehicles (ships, trains, aircraft) and inside related port or terminal buildings. For indoor use only. Treated baits must be placed in tamper-proof bait boxes or in locations not accessible to children, pets, domestic animals or wildlife. Do not place bait in areas where there is a possibility of contaminating food or surfaces that come in direct contact with food.

SELECTION OF TREATMENT AREAS: After removing as much food, water and harborage as possible, determine areas where rats or mice will most likely find and consume the bait. Generally, these areas are along walls, by gnawed openings, in or beside burrows, in corners and concealed places, between floors and walls, or in locations where rodents or their signs have been observed.

APPLICATION DIRECTIONS

Norway and Roof Rats

Apply 4 to 16 ounces of bait (usually at intervals of 15 to 30 feet) per placement. Maintain an uninterrupted supply of fresh bait for 10 days or until signs of rat activity cease.

House Mice

Apply ¼ to ½ ounce of bait at intervals of 8 to 12 feet per placement. Larger placements (up to 2 ounces) may be needed at points of very high mouse activity. Maintain an uninterrupted supply of fresh bait for 15 days or until signs of mouse activity cease.

Rats & Mice

Replace contaminated or spoiled bait immediately. Collect and dispose of all dead animals and unconsumed bait properly. Repeat treatment when infestation recurs. Where continuous source of infestation is present, establish permanent bait stations and replenish bait as needed.

Kills warfarin-resistant Norway Rats.

Rodents may consume a lethal dose in one feeding with first dead rodents appearing four or five days after treatment begins.

Active Ingredient:

3-[3-(4'-bromo[1,1'-biphenyl]-4-yl)-1,2,3,4-tetrahydro-1-naphthalenyl]-4-hydroxy-2H-1-benzopyran-2-one

Inert Ingredients	0.005%
Total	99.995%
	100.000%

**KEEP OUT OF REACH
OF CHILDREN
CAUTION**

May Be Harmful or Fatal if Swallowed.
Read Additional Precautionary Statements on Side Panel.



ICI Americas Inc.

Wilmington, Delaware 19897

EPA Reg. No. 10182-26

EPA Est. No. 523-IL-1

Net Contents: 45 lb (20.2 kg)

Batch Number

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS CAUTION

MAY BE HARMFUL OR FATAL IF SWALLOWED. KEEP AWAY FROM HUMANS, DOMESTIC ANIMALS, AND PETS. WASH HANDS AFTER HANDLING BAIT. IF BAIT IS EATEN BY HUMANS, CALL A PHYSICIAN AT ONCE.

For 24-hour emergency assistance call 302/575-3000.

In case of significant spill, call CHEMTREC 800/424-9300.

NOTE TO PHYSICIAN

This product may reduce the clotting ability of the blood and cause hemorrhaging. If this occurs, intravenous and oral administration of vitamin K₁ combined with blood transfusions are indicated as in the case of hemorrhage caused by overdoses of bishydroxycoumarin. Vitamin K₁ is antidotal at doses of 10 to 20 mg.

ENVIRONMENTAL HAZARDS

This product is toxic to fish and wildlife. Keep out of lakes, streams or ponds.

STORAGE AND DISPOSAL

STORAGE: Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Do not reuse empty container.

DISPOSAL: Bait that cannot be used should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Dispose of container in an incinerator or landfill approved for pesticide containers, or bury in a safe place. Consult Federal, State or local disposal authorities for approved alternate procedures such as limited open burning.



ICI Americas Inc.

COPY 1

Regulatory Affairs
Department

HAND DELIVERED

February 26, 1980

Mr. William H. Miller
Product Manager, Team 16
Insecticide-Rodenticide Branch
Registration Division TS-767
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Mr. Miller:

Re: TALON Rodenticide
Pending Registrations
For Outdoor Uses

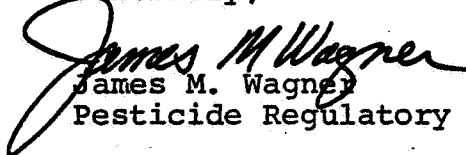
As you know, TALON Rodenticide is currently registered by EPA for indoor use only under registration numbers 10182-20, 21, 24 and 26. ICI also has registrations currently pending for outdoor uses of TALON, such as around agricultural premises.

In connection with the proposed outdoor uses of TALON, EPA Fish and Wildlife Reviewers have requested that ICI assess the degree of hazard to avian nontarget species, especially raptors. As part of this effort, ICI is proposing to cooperate with the U.S. Fish and Wildlife Service, Wildlife Research Center, Denver, Colorado in a study to evaluate the secondary hazards to barn owls resulting from the outdoor use of TALON for controlling rats and mice.

A copy of the proposed study protocol is attached and ICI respectfully requests your review and comments. Recognizing that an Experimental Use Permit will be necessary to conduct this proposed study, we will be officially requesting such a permit in the next few weeks. Since the proposed start up for the study is this spring, we would welcome your early comments on the protocol. It may also be beneficial for us to meet with you in the near future to more fully discuss your comments.

Thank you for your prompt attention to this matter.

Sincerely,


James M. Wagner
Pesticide Regulatory Specialist

JMW/dmp/M/49
Attachment
Submitted in triplicate

COOPERATIVE AGREEMENT
U. S. FISH AND WILDLIFE SERVICE,
WILDLIFE RESEARCH CENTER
DENVER, COLORADO
WORK UNIT 929.04

This Cooperative Agreement is between ICI Americas, Inc. (ICI) and the Denver Wildlife Research Center (DWRC), Building 16, Federal Center, Denver, Colorado 80225.

1. Work Unit Title

Evaluation of secondary hazards to barn owls (Tyto alba) resulting from the use of TALON* (brodifacoum bait) for controlling rats (Rattus spp.) and house mice (Mus musculus).

2. Project Title

The study being proposed is a segment of research under project 929, Mammal Damage Control Research--Environmental Impact--Economic Analysis.

3. Program

Animal Damage Control (86870-1230-929).

4. Principal Investigator

Paul L. Hegdal, wildlife biologist, Denver Wildlife Research Center, is assigned primary responsibility for this study. Other DWRC personnel will assist as necessary during the study.

* Reg. trade name of ICI Americas, Inc., Wilmington, Delaware 19897.

5. Objective

1. To determine if brodifacoum baiting for rats and mice in and around farm buildings has a secondary effect (direct mortality or increased blood coagulation time) on barn owls.

6. Justification and Background

There is an interest in expanding the use of brodifacoum bait (Talon) to control rats and house mice in and around buildings. The Environmental Protection Agency (EPA) has indicated that a field study including the use of radio telemetry equipment should be conducted to evaluate the potential hazards of this proposed use to barn owls. Even though food habits studies by many researchers indicate that rats and house mice do not generally make up a large part of the owls' diet, some of these rodents are consumed by barn owls, especially in situations where other small mammal prey are scarce (Smith and Hopkins 1937, Selleck and Glading 1943, Pearson and Pearson 1947, Phillips 1951, Rushing 1951, Parmalee 1954, Cunningham 1960, Maser and Brodie 1966, Holgersen 1970, Geer and Gilstrap 1970, Lee 1972, Rickert 1972, Smith et al. 1972, Marti 1973, Webster 1973, Glue 1974, Homer et al. 1974, Clark and Wise 1974, Karalus and Eckert 1974, Smith and Marti 1976, and Dawe et al. 1978]. For example, Fairley [1966] reported that barn owls in northern Ireland consumed up to 30% rats and 15% house mice. In this area, rats, house mice, and only two other small mammals (the wood mouse (Apodemus sylvaticus) and pygmy shrew (Sorex minutus) make up

most of the small mammal biomass available as prey. Also Buden (1974) reported rats make up 76% of the barn owls diet in the Southern Bahama Islands. However, again in this case, rats make up most of the small mammals available as prey.

In the United States voles (Microtus spp.) are usually taken in the greatest numbers but most authors agree that barn owls are opportunistic feeders and will take most small mammals that are available in the area. Also, barn owls that roost or nest in farm buildings or near farmsteads generally have higher intakes of rats and house mice.

There is information in the literature that indicates there are potential problems with secondary poisoning of both birds and mammals with the use of anticoagulants. Evans and Ward (1967) fed nutria (Myocastor coypus) killed with anticoagulants to mink (Mustela vison) and dogs (Canis familiaris) and observed toxic reactions and death in these animals. Savarie et al, (1978) found that muscle from coyotes (Canis latrans) killed by a single dose of diphacinone was toxic to white rats. Also, Savarie et al. (1978) observed toxic manifestations in golden eagles (Aquila chrysaetos) fed meat from sheep (Ovis aries) that had been killed with a single dose of diphacinone. Mendenhall and Pank (unpublished data) compared the secondary toxicity of six anticoagulants to barn owls. Rats (Rattus norvegicus, R. rattus, and R. exulans) were killed by feeding on the anticoagulant bait

for 5 days and then were offered singly to individual owls for periods of 1, 3, 5, 6 or 10 days. Owl mortalities were recorded when they fed upon rats treated with brodifacoum and bromadiolone. Owls that fed on difenacoum-killed rats hemorrhaged, but did not die. Other owls that fed on rats killed with diphacinone, fumarin, or chlorophacinone survived and did not display any gross poisoning symptoms.

Savarie and LaVoie (unpublished) reported that some American kestrels (Falco sparverius) died after feeding on brodifacoum-killed meadow voles (Microtus pennsylvanicus) for 6 days. Kestrels did not die after feeding on brodifacoum-killed voles for 2 days but prothrombin times were elevated even 71 days posttreatment.

7. Methods

a. Study area

The study area will be located in one of the following areas, New Jersey, eastern Pennsylvania, Delaware and eastern Maryland.

Up to 20 farmsteads that have at least one barn owl using some structure for roosting or nesting will be selected. All farmsteads selected must also have populations of rats and house mice in and around farm buildings.

b. Barn owls

Up to 20 barn owls will be captured and equipped with radio transmitters. Transmitters will be constructed with a

mortality circuit [the transmitter changes pulse rate if it remains still for one hour]. Animals will be radio-tracked daily to determine movement patterns and feeding areas before, during, and for at least one month after treatment of the farmstead with Talon bait. Any owls that die during the study will be necropsied and tissues will be preserved for residue analysis. Regurgitated owl pellets will be collected from each roosting site and analyzed to determine normal food habits of the owls. Pellets will also be collected at least weekly from each site during the study. Blood samples from control barn owls will be taken at the time of initial capture to determine blood coagulation time and prothrombin times. Blood samples also will be taken from young in nests at appropriate times posttreatment and from radio-equipped owls at an appropriate time after treatment.

Nest boxes may be placed at suitable farmsteads that do not have owls nesting or roosting but have rat and mouse populations. If these boxes are utilized by barn owls, the site will be used as one of the study sites.

c. Rats and mice

Placebo bait consumption from bait boxes by rats and mice will be determined for a 3-week period at each site prior to treatment to establish the existence of a rat or mouse population. Four bait boxes will be used at each site. One month posttreatment placebo bait consumption will again

be determined for a 3-week period at each site. The reduction in bait consumption will be used as an index to mortality in the rat and mouse populations at each site.

d. Treatment

Study sites randomly selected as treatment sites will be treated with Talon bait by ICI and DWRC personnel according to recommended procedures of current Talon registration for use inside buildings.

Demethylchlorotetracycline (DMCT), a marking agent will be incorporated in the bait (at a concentration of 0.1%).

This material chelates with the calcium and will fluoresce on the lower jaw of rodents consuming the bait (Crier 1970).

By collecting and examining owl pellets (in which the lower jaws pass intact) we will be able to determine if owls are consuming rodents that have consumed the Talon bait. We also will determine what percentage of the owl's diet is made up of the various prey species including rats and mice.

e. Data analysis

Data on barn owl home ranges and movement as determined by telemetry will be mapped (plotted) and compared to determine any treatment-related changes in activity and to determine if these owls were exposed to the treatment. Home ranges will be determined by the Cedar Creek computer software programs (Homer etc.). Owl mortality (if it occurs) will be compared by Chi-square analysis.

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Data on blood coagulation time and prothrombin time will be analysed by analysis of variance.

Owl pellet content data will be analyzed by a multinomial analysis.

Reduction in bait consumption by rats and mice will be analyzed by paired t-tests.

8. Section 7--R and E Consultation

We have determined that our research activities will not affect endangered species and does not require formal consultation.

However, we will maintain close communication with the U. S.

Fish and Wildlife Service Region 5 and the area offices involved to make them aware of study plans and progress.

9. Employee Safety

Talon baits will be stored, handled and dispensed following all safety precautions and directions on the currently registered label of bait for inside use and also according to directions of the experimental use permit.

10. Schedule

Field work will be completed during the spring and summer of 1980. It is anticipated that all field work will be completed by 30 September 1980.

A draft report will be prepared 2 months after completion of field work. Publications resulting from this study will be the sole responsibility of the principal investigator.

11. Staffing

Primary responsibility for this study is assigned to Paul L. Hegdal. Additional personnel will be temporarily assigned from other projects of the Section of Mammal Damage Control and possibly other sections of the Center. ICI personnel will be responsible for assisting in baiting and for analysis of tissues for residues of brodifacoum.

12. Cost Estimates

1. Salaries	\$18,000
2. Equipment--pulse counters, antennas, head sets	1,000
3. Supplies--Radios, nets, nest boxes and climbing gear	2,600
4. Travel-- Common carrier	4,000
Per Diem	10,000
Vehicle operation	3,000
5. Data analysis and reporting	<u>1,000</u>
	\$39,600
6. Overhead 12%	<u>5,400</u>
	\$45,000

Contingency

If residue analysis becomes necessary, each analysis will cost \$40.00. The contract cost will be increased correspondingly by the number of analysis needed. We would not expect to have more than 50 samples. Thus the contract costs would not increase by more than \$2,000.

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Submitted By:

Paul L. Hegdal (Date)

Concur:

(Date)

Statistician (Date)

Approved By:

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Chief, Section of
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Director, Denver
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